

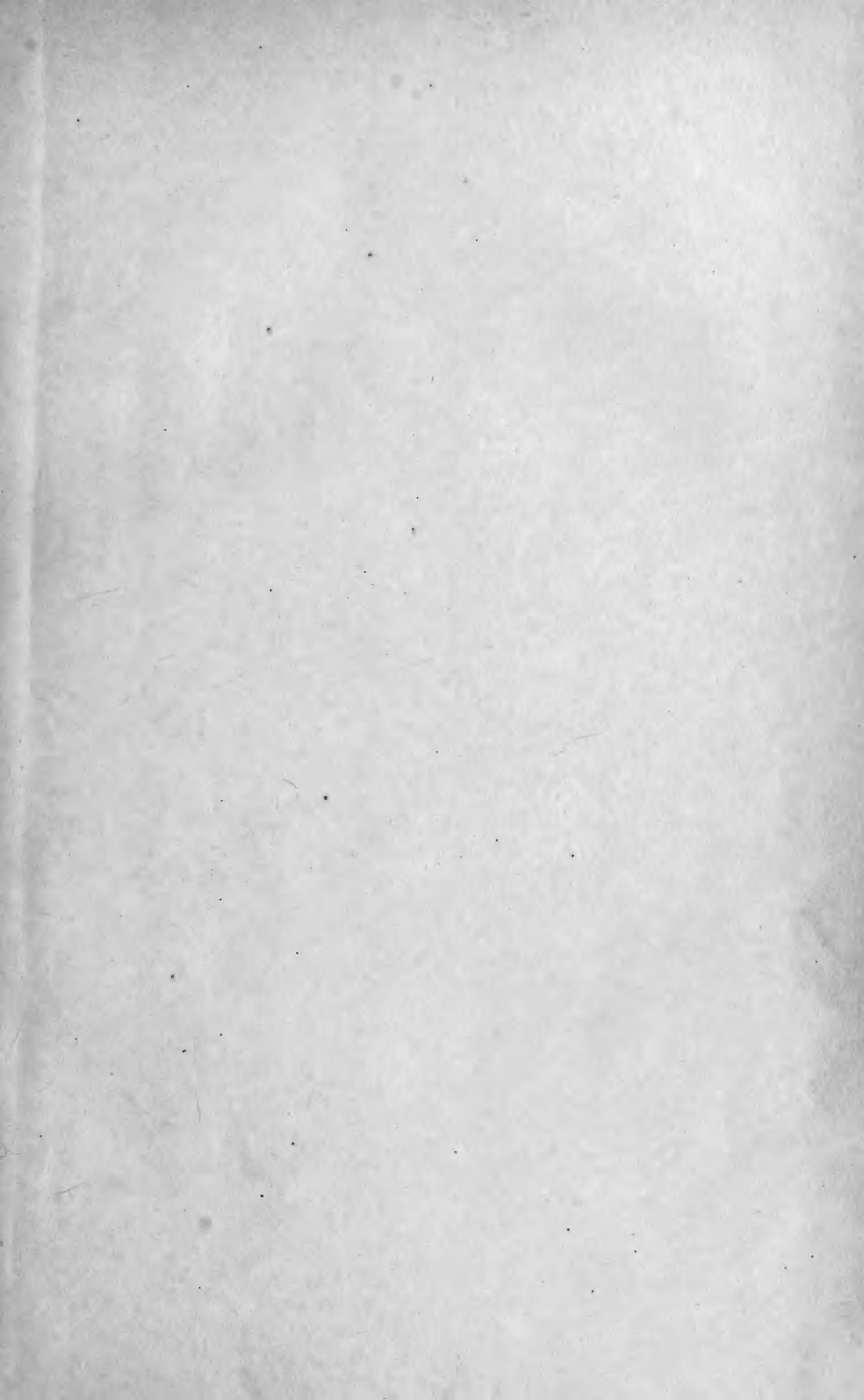
P. W. D. M.





✓
Bathbun, R.

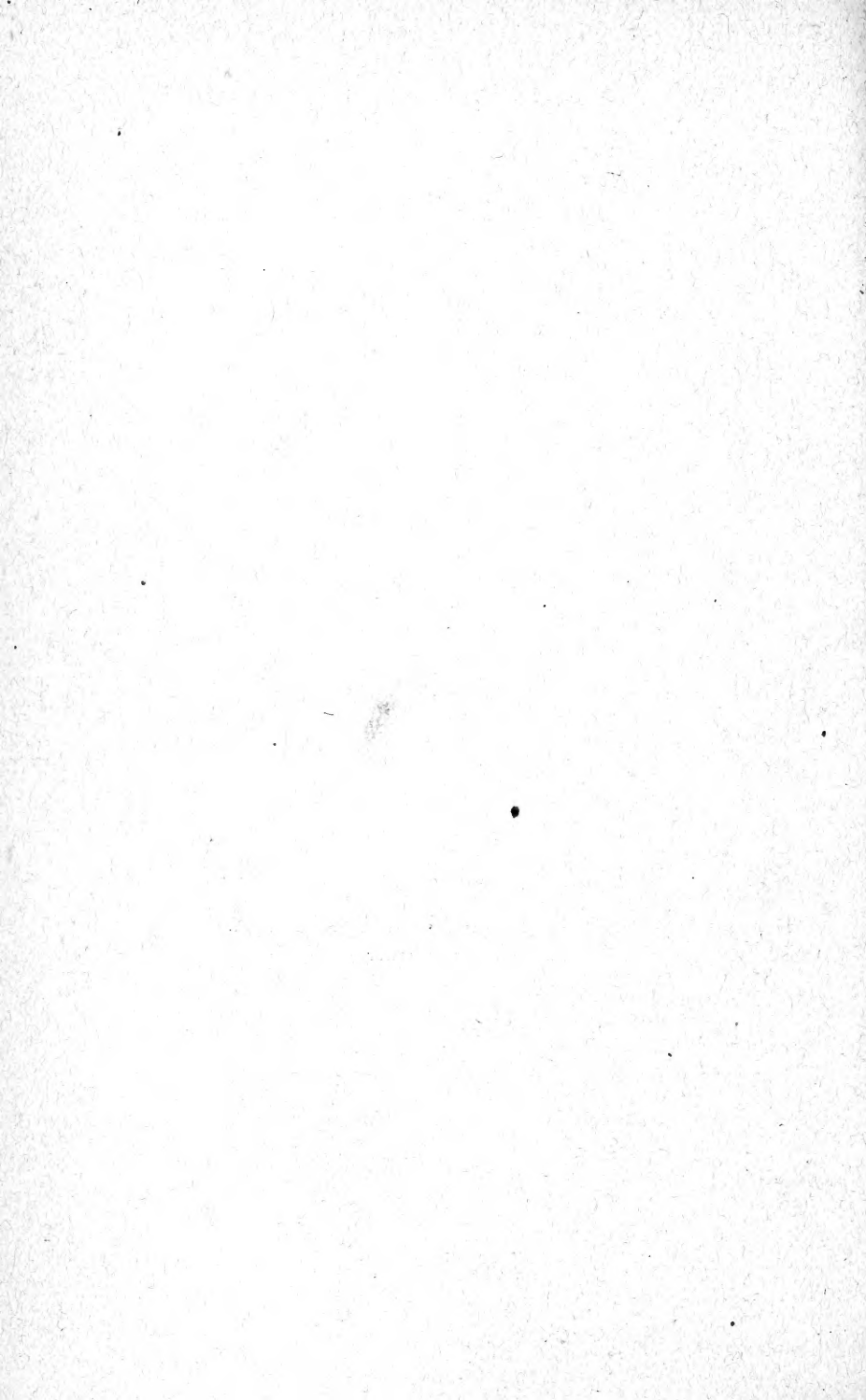




From the Proceedings of the Boston Society of Natural History,
Vol. xx, May 15, 1878.

THE DEVONIAN BRACHIOPODA
OF THE
PROVINCE OF PARÁ, BRAZIL.

By **RICHARD RATHBUN,**
LATE ASSISTANT GEOLOGIST TO THE GEOLOGICAL COMMISSION
OF BRAZIL, PROF. CH. FRED. HARTT, CHIEF.



From the Proceedings of the Boston Society of Natural History,
Vol. XX, May 15, 1878.

THE DEVONIAN BRACHIOPODA

OF THE

PROVINCE OF PARÁ, BRAZIL.

By RICHARD RATHBUN,

LATE ASSISTANT GEOLOGIST TO THE GEOLOGICAL COMMISSION
OF BRAZIL, PROF. CH. FRED. HARTT, CHIEF.

From the Proceedings of the Boston Society of Natural History,
Vol. XX, May 15, 1878.

THE DEVONIAN BRACHIOPODA OF THE PROVINCE OF PARA, BRAZIL. BY RICHARD RATHBUN, LATE ASSISTANT GEOLOGIST TO THE GEOLOGICAL COMMISSION OF BRAZIL, PROFESSOR CH. FRED. HARTT, CHIEF.

The present paper is an abridgement of a report made to His Excellency, the Minister of Agriculture of Brazil, in 1877, and constitutes a complete list of the Devonian Brachiopods at present known from the Lower Amazonian Valley, with descriptions of several new species, and notes on those previously described. This

report should properly follow the detailed account of the Devonian deposits of the Amazonas, which forms a chapter of considerable length in the first unpublished volume of the Geological Commission. The death of Professor Hartt has, however, delayed the publication of that work for a short time, and it has been deemed advisable to issue this report on the fossils at once. It thus becomes necessary to describe here in brief the localities where the species treated of in this paper were obtained, and the character and relations of the rocks in which they were found.

Prof. Hartt discovered on the Morgan Expedition in 1870 the interesting Devonian locality of Ereré, near Monte Alegre, on the Amazonas, where he procured the first Devonian fossils found east of the Andes in South America. In the following year he revisited Ereré, and made large additions to his former collections from there. This region he has fully described in the Bulletin of the Buffalo Society of Natural Science, for January, 1874 (pp. 201 to 235), and in the same publication (pp. 236-261) I have given descriptions of the Devonian Brachiopods obtained by him. In 1876, Mr. Orville A. Derby, of the Brazilian Commission, accompanied by Dr. F. José de Freitas and Mr. H. H. Smith of the same Commission, reexamined the geology of Ereré, and traced the Devonian formation for some distance northward of that region, on the Rios Mæcurú and Curuá, finding on each of these two rivers richly fossiliferous sandstones. Passing northward from Ereré, the beds are crossed in descending order, so that the deposits of Ereré are newer in age than those of the Rios Mæcurú and Curuá.

The fossiliferous sandstones of the Rio Curuá appear to be identical with those on the Mæcurú, although the characters of the beds at the two places differ slightly; at the former locality they are fine in texture and hard, while at the latter place they are coarse and friable. At both of these localities, which are distant from one another about twenty-five miles, the fossils are confined to a limited series of beds. From the Mæcurú locality to the Ereré the distance is about seventy-five miles, the thickness of the intervening deposits, which are largely composed of beds of chert, being in the neighborhood of one hundred feet.

At Ereré only three additional species of Brachiopods were found; but on the Mæcurú and Curuá were discovered thirteen species new to the Brazilian Devonian fauna, of which three species are identical with New York State forms and the remainder, at least in part, new

to science. The fauna of the two series of deposits — the Ereré on the one hand, and the Mæcurú and Curuá on the other—are closely related, but I will leave the discussion of this subject for the close of the paper.

The collections of the Morgan Expeditions referred to in the following pages are contained in the Museum of Cornell University, Ithaca, New York; those of the Geological Commission of Brazil are at present deposited in the National Museum at Rio de Janeiro. Figures of many of the new species described in this paper were executed at Rio de Janeiro a year ago, and will probably be published in some future work of the Geological Commission.

Lingula spatulata (?) Hall.

Lingula spatulata Hall and Vanuxem, Geol. Repts., Third and Fourth Geol. Dists. N. Y., 1842 and '48; Hall, Palæont. of N. Y., IV, 13, 1867. *Lingula spatulata* (?) Rathbun, Bull. Buffalo Soc. Nat. Sci., I, no. 4, 258, fig. 1, 1874.

Only a single specimen of this species has been obtained from the Devonian of Brazil. Sandstone, Ereré, Prov. of Pará, Brazil. (Morgan Expedition, 1871.)

Lingula ererensis, sp. nov.

Shell of medium size, about two-thirds as wide as long, subelliptical in outline, and broadest near the middle; lateral margins nearly straight along the middle, but curving very slightly; anterior and posterior margins rounded, the former apparently the broader, and very regularly and strongly curved. Valves moderately convex, with a tendency to form a more or less defined median ridge near the beak. Surface marked with very fine, regular, closely-set concentric lines, which are only distinctly seen by the aid of a lense. In the interior of one valve exists a narrow V-shaped impression, having the point turned toward, and ending near, the beak. Length of the shell about 18 mm., breadth about 12 mm.

This species of *Lingula* is quite distinct from any of the other forms at Ereré. In outline it approaches *L. delia* Hall, of the Hamilton group of New York State, and like that species it has the fine concentric surface lines. The single specimen found is, however, too imperfect to permit of its relations to the above mentioned species being accurately determined.

Associated with *Spirifera Pedroana*, etc., in the Devonian sandstone of Ereré. (Geological Commission, 1876.)

Lingula Rodriguezii Rathbun.

Bull. Buffalo Soc. Nat. Sci., 1, no. 4, p. 260, 1874.

Found, with *Discina lodensis*, in the Devonian shales of Ereré. (Morgan Ex., 1870.)

Lingula Stauntoniana Rathbun.

Bull. Buff. Soc. Nat. Sci., 1, no. 4, p. 259, fig. 3, 1874.

Moderately abundant in the Devonian shales of Ereré, associated with *Discina lodensis*, etc. (Morgan Ex., 1871; Geol. Comm., 1876.)

Lingula Gracana Rathbun.

Bull. Buff. Soc. Nat. Sci., 1, no. 4, p. 259, fig. 2, 1874.

Rare in the Devonian shales of Ereré, associated with *Discina lodensis*. (Morgan Ex., 1870; Geol. Comm., 1876.)

Discina lodensis Hall.

Orbicula lodensis Vanuxem, Geol. Rept. Third Dist. N. Y., p. 168, 1842; Hall, Geol. Rept. Fourth Dist. N. Y., p. 223, 1843. *Discina lodensis* Hall, Palæont. N. Y., iv, p. 22, 1867; Rathbun, Bull. Buff. Soc. Nat. Sci., 1, no. 4, p. 257, 1874. Compare *Discina media* Hall, Palæont. N. Y., iv, p. 20, 1867.

This species is very abundant in the dark shales of the Devonian of Ereré, and the collections obtained from there, represent it in its various stages of growth, from the very young to the adult shell. (Morgan Exs., 1870 and '71; Geol. Comm., 1876.)

Productella mæcuruensis, sp. nov.

Shell small and slightly asymmetrical in shape; length and breadth nearly equal, giving an irregularly subcircular outline to the shell, which is somewhat flattened posteriorly; hinge line straight and slightly shorter than the width of the shell; cardinal extremities not preserved in the single specimen obtained.

Ventral valve very convex (but rather less so than is usually the case in this genus), quite strongly curved from side to side, and strongly and nearly regularly curved from the beak to the front, the point of greatest prominence of the valve being, however, slightly posterior to the middle. Beak rather small, but strongly arched and regularly rounded, and projecting some distance behind the hinge line. The convexity of the umbo broadens with moderate rapidity forward, leaving the portions of the valve bordering the cardinal extremities slightly and irregularly flattened. The want of symmetry in the ventral valve results from the beak and more prominent line of curvature lying a little nearer the right margin than the left. Dorsal valve unknown.

The markings of the shell are indistinctly preserved in the single specimen I have examined; they appear to consist of short, low, rounded, radiating, raised lines, which are narrower than the intervening spaces. They are of variable lengths—one-eighth to one-sixth that of the valve, or more—and some appear to extend the entire length of the valve. They are more or less regularly distributed, and the anterior end of each line is slightly elevated, as though it had formed the base of a spine. The bases of two or three small spines are preserved near the right cardinal angle. Length and breadth of shell each about 9.5 mm.

Having only one specimen of this form, it is impossible to determine to what described species of *Productella* it may be the most closely related. The number of species of *Productella* described from the Devonian of North America is so large, that it is probable the form under discussion may ultimately fall into one of them. It bears a certain resemblance to several of Hall's species, more particularly *P. navicella* of the Corniferous limestone and Hamilton group of New York.

Devonian sandstone of the Rio Mæcurú, Pará. (Geol. Comm., 1876.)

Chonetes Comstockii Hartt, MS.¹

Rathbun, Bull. Buff. Soc. Nat. Sci., 1, no. 4, p. 250, pl. ix, 1874.

Devonian sandstone, Ereré. (Morgan Exs., 1870 and '71; Geol. Comm., 1876.) Rio Mæcurú. (Geol. Comm., 1876.)

This species is of very common occurrence at Ereré, but only three small specimens were obtained from the Rio Mæcurú.

Chonetes Freitasii, sp. nov.

Shell usually quite strongly concavo-convex, and varying in outline from longitudinally semi-elliptical to transversely sub-elliptical or oblong; proportions of length to breadth as 6 to 7, 5 to 6, 3 to 4 or 2 to 3. Hinge line straight and, in the majority of cases, equalling the width of the shell or more. Cardinal extremities forming right or acute angles, and often much extended in sharp, mucronate points; but frequently the hinge line is shorter than the width of the shell, and the cardinal extremities are then obtusely angular or regularly rounded. Where the length of the hinge line equals the width of the

¹By an oversight in the original paper on the Devonian Brachiopoda of Ereré (*loc. cit.*), I omitted to state that the names of the species therein accredited to Professor Hartt were taken from his manuscript notes.

shell, the lateral margins are straight and sub-parallel posteriorly, and anteriorly form, with the anterior margin, quite a regular semi-elliptical curve, or the anterior margin may be nearly straight along the middle. In other cases the curve of the margins from one cardinal angle to the other is quite regular, and subcircular or semi-elliptical.

Ventral valve generally very convex, and often gibbous or inflated; but at times much depressed. In specimens where the length and breadth of the shell are nearly equal, the valve is usually very regularly convex, and the curvature from side to side, and from the beak to the front, are subequal. The broader forms are frequently slightly, but broadly, flattened along the middle, along which there is often a shallow, undefined median depression of variable breadth, always beginning some distance anterior to the beak. At the cardinal extremities, and for some distance in front of them along the lateral margins, the valve is always flattened. In the larger specimens the width of the hinge area at the beak is from about 1 mm. to 1.5 mm.; at the cardinal angles it narrows down to about one-third its width at the beak. The beak is small and only slightly extended beyond the hinge margin. In the interior of the shell, there exists a thin, but distinct, median septum, equal to one-fifth or one-half the length of the valve, and sometimes quite heavy, but not elevated. Spines are indicated on a single specimen only. On this are preserved the bases of five spines, sub-equidistant from one another, and inclining outward at an angle of about fifty-five degrees.

Dorsal valve strongly concave, generally most concave near the middle, and having the curve from the beak to the anterior margin quite regular, but sometimes more rapid near the front. The cardinal angles are flattened, and along the middle there is frequently an undefined ridge, corresponding with the depression in the ventral valve. A few specimens show slight impressions of a medium sized cardinal process, but no septum occurs. The beginnings of the vascular impressions, directly in front of the cardinal process, and two short, slightly diverging ridges anterior to, and included between, the impressions are often preserved.

The raised lines of the shell are quite prominent, and slightly rounded or sub-angular on top; they are narrower than the intervening depressions, which are rounded in the bottom. The surface is often smooth at the cardinal extremities, and old shells are frequently much thickened along the hinge line. Four specimens of different shapes and sizes afford the following measurements, in connection

with which are given the number of raised lines that mark the surface near the margin: (1) length 11 mm., breadth 13 mm., height 2.25 mm., raised lines thirty (absent from cardinal angles); (2) length 11.5 mm., width 14 mm., height 4 mm., raised lines forty; (3) length 13 mm., width 18 mm., height 3.5 mm., raised lines thirty-two (wanting on cardinal angles); (4) length 20 mm., width 29 mm., height 4.5 mm., raised lines forty-eight.

In this species we have included a number of forms, which might have served for the formation of several species were not the material in our possession so abundant as to afford a complete series of variations, uniting the different forms closely together. The younger shells are proportionately the narrower, and in after growth they increase more rapidly in width than in length. The younger forms are also frequently more convex in proportion to their size, than are the older, which often become broadly flattened or depressed along the middle. The older and broader forms are the more abundant ones. The smaller varieties of this species, having the length and breadth about equal, appear to represent *Chonetes deflecta* Hall, of the Hamilton group of New York State; the larger, more transverse forms, however, more closely resemble, at least in shape, some of the large species of *Chonetes* described by Prof. Hall from the Upper Helderberg group of New York. The nearest related one seems to be *C. acutiradiata* Hall.

This species of *Chonetes* is exceedingly abundant in the Devonian sandstone of the Rio Mæcurú, and the collection brought from there is very large, representing many varieties. A few specimens were also found on the Rio Curuá. The single ventral valve of a *Chonetes* described, but not named, in the Bull. Buff. Soc. Nat. Sci., Jan. '74, p. 253, very probably belongs to this species.

Rios Mæcurú and Curuá. (Geol. Comm. 1876.) Ereré. (?) (Morgan Ex., 1871.)

Chonetes Onettiana Rathbun.

Bull. Buff. Soc. Nat. Sci. 1, no. 4, p. 253, pl. x., 1874.

Rare in the Devonian sandstone of Ereré. (Morgan Exs., 1870 and '71; Geol. Comm., 1876.)

Chonetes Herbert-Smithii Hartt, MS.

Rathbun, Bull. Buff. Soc. Nat. Sci., 1, no. 4, p. 251, pl. x, 1874.

An examination of the many specimens of *Chonetes* obtained at Ereré in 1876, proves a greater variation to exist among the forms referred to this species than was previously indicated, and it is prob-

able that we have more than a single species included in *Chonetes Herbert-Smithii*, as originally founded. Much of the material at hand is in an imperfect state of preservation, the majority of the specimens, however, belonging to the type as first described. Thus it does not seem advisable to make a division of the species, until other and better material has been obtained.

Moderately abundant in the Devonian sandstone of Ereré. (Morgan Exs., 1870 and 71; Geol. Comm., 1876.)

***Chonetes curuaensis*, sp. nov.**

Shell small and transverse, with the proportions of length to breadth about as 2 to 3; in outline longitudinally sub-semielliptical, the lateral margins being nearly straight posteriorly, and not curving much, excepting toward the front. Hinge line straight and nearly or quite as long as the width of the shell, which has the cardinal extremities forming right angles or, probably, slightly rounded.

Ventral valve gently convex and most elevated near the middle, but having the convexity slightly more pronounced on the umbonal region than toward the front of the valve. Curve along the transverse diameter gentle and nearly regular, though the sides of the valve appear to slope from the median line to the lateral margins with little curvature. Cardinal extremities flattened. Beak small, but distinctly marked, slightly depressed and projecting only a short distance behind the hinge line. There is a small, well-defined septum, extending forward from the beak a little more than one-fourth the shell length. Hinge area and spines not preserved. Surface marked with fine, but prominent, subangular, radiating raised lines, which are slightly narrower than the intervening depressions. There are about twenty-six of these lines on one ventral valve, on which, however, the cardinal extremities are smooth; there also exist one or two rather prominent, concentric lines of growth. Length of valve about 6 mm., breadth 9 mm. Dorsal valve unknown.

This species of *Chonetes*, which is represented by only a single perfect specimen, bears some resemblance to *C. Herbert-Smithii* of the Ereré locality, from which, however, it differs in the fact that the ventral valve of the former is less strongly convex, and has a more prominent beak and finer surface markings. It also resembles somewhat the young of *C. Freitasii* of the Rio Mæcurú locality. From *C. scitula* Hall, of the Hamilton group of New York State, which it resembles much in form, it differs in having fewer and coarser raised lines. Only a few specimens of this species have been found.

Devonian sandstone, Rio Curuá and doubtfully on the Mæcurú. (Geol. Comm., 1876.)

Chonetes, sp. indet.

There was obtained from the Devonian sandstone of the Rio Mæcurú a very small, smooth form of *Chonetes*, represented by only two specimens, which do not appear to belong to any of the species already described in this paper. The specimens are not, however, well enough preserved to permit of their being accurately determined.

Orthis Nettoana Rathbun.

Bull. Buff. Soc. Nat. Sci., 1, no. 4, p. 247, pl. x, 1874.

The finding of larger, more perfect specimens of this species in 1876 necessitates the following new description.

Shell small, with the valves subequally convex, or with the dorsal valve depressed and much less prominent than the ventral. Ventral valve subcircular or transversely subelliptical in outline; dorsal valve subelliptical. Greatest width of the shell near the middle; length of the hinge line equal to two-thirds the greatest width, or a little less; cardinal extremities rounded. Shell marked with radiating, raised lines.

Ventral valve quite convex and most prominent at, or just posterior to, the middle, whence the slope is very gentle toward the beak, but rather rapid toward the front. Surface of the valve curving regularly from side to side, or descending from the median line to the lateral margins with little curvature; curve from the beak to the front sometimes very regular. Cardinal extremities broadly and regularly rounded. In the broader forms the anterior margin is straightened along the front, or even slightly indented. Hinge area high, broadly triangular, with a broad triangular fissure, which sometimes occupies half of the area or more. Beak acute, but not extending beyond the line of the cardinal margins and scarcely incurving.

Dorsal valve moderately convex, sometimes depressed-convex, and generally with a broad, shallow, undefined median depression, which commences near the beak, and broadens rapidly toward the front, where its width equals one-third to one-half that of the valve. Beak depressed; hinge area narrow.

Dental lamellæ of the ventral valve, more or less separated at the beak, and extending forward, nearly parallel with one another, or diverging slightly. They are generally curved, their concave surfaces facing inwards. Distance between the lamellæ equal to about one-fifth or one-seventh the width of the valve; their length, one-

fourth that of the valve, or slightly more. The socket plates of the dorsal valve extend in about the same direction, or diverge slightly more, but they are not as long as the lamellæ. Cardinal process not preserved.

Shell marked with fine, closely arranged, radiating raised lines, which are of about the same width as the depressions separating them, or slightly broader. They appear to increase in number mostly by intercalation. An elliptical specimen measures, length 15 mm., breadth 21 mm.; a nearly circular one, length 15 mm., breadth 16 mm.

This species belongs to the type of *Orthis lenticularis*, of the Upper Helderberg Group of New York, though specifically it does not resemble any N. American form. It is represented in the Devonian sandstone of Ereré by only a few very small specimens; many specimens of larger size were, however, obtained from the Rio Mæcurú. Two or three small specimens were found in the sandstone of the Rio Curuá. (Morgan Exs., 1870 and '71; Geol. Comm., 1876.)

***Orthis Harttii*, sp. nov.**

Shell of medium to large size, transverse, subplano-convex, or with the ventral valve slightly convex on the umbo. Dorsal valve broadly subovate in outline; ventral, transversely subelliptical. Hinge line short, equal to about one-third to one-half the width of the shell. Surface marked with fine, radiating raised lines.

Ventral valve broadest near the middle; proportions of length to breadth about as 2 to 3, or length and breadth nearly equal. There is an undefined, shallow, and rather narrow, median sinus, which causes a slight indentation in the anterior margin of the valve. It commences some distance forward of the beak, and is often scarcely developed at all. Beak of medium size, prominent and acutely pointed, and projecting a short distance beyond the hinge line. The surface of the valve curves up rapidly from the hinge line toward the middle of the valve, but all the median and anterior portion of the valve is broadly flattened, and at times depressed to form the sinus.

Dorsal valve moderately convex, and broadest just anterior to the middle, the margins curving rapidly outward and forward from the beak to the point of greatest width, in front of which the margins form a regular curve, so that, as a rule, the valve has quite a perfect, broad-ovate outline. Along the median line the valve is usually broadly, but not strongly, elevated in an undefined prominence, reaching from near the beak to near the front of the valve. This el-

evated portion is rounded on top, or is marked by a faint longitudinal depression. It broadens rapidly forward, at the same time decreasing in height; near the middle of the valve its width equals about one-third that of the valve, or a little more; at the front it is one-half the width of the valve; at the sides it rounds over rapidly toward the lateral and posterior margins. Beak small and pointed; hinge area short, triangular.

In the interior of the dorsal valve there exists a rather small, but prominent and projecting, cardinal process, and moderately heavy dental plates, which latter diverge at an angle slightly less than a right angle. Septum broad, very slightly elevated, and reaching nearly to the middle of the valve. Muscular impressions of the ventral valve large and extending beyond the middle of the valve. They broaden rapidly from the beak forward, attaining their greatest breadth near the front, which is slightly rounded. A medium-sized septum separates them to the front. Surface marked with fine, closely placed, radiating raised lines which are sometimes slightly broader, at others slightly narrower, than the intervening striæ.

A dorsal valve measures, length 25 mm., breadth 30 mm.; a ventral valve, length 23 mm., breadth 32 mm.

This species apparently belongs to that group of *Orthis*, in which Prof. Jas. Hall has placed *O. Vanuxemi*, *O. leucosia*, *O. penelope* and *O. cyclos* of the Hamilton group of New York State, with the characters of which the new shell agrees quite perfectly in the dorsal valve, and also in the ventral valve, excepting that the latter is sometimes proportionally broader than the dorsal.

Quite abundant in the Devonian sandstone of the Rio Mæcurú, and also found at the Rio Curuá locality. (Geol. Comm., 1876.)

***Streptorhynchus Agassizii* Hartt, MS.**

Rathbun, Bull. Buff. Soc. Nat. Sci., 1, no. 4, p. 248, pl. ix, 1874.

In the large collection of this species, made on the Rio Mæcurú by the Geological Commission in 1876, there are to be noted only a few variations beyond those already recorded in the original description of the species. The forms from the two localities, Ereré and the Mæcurú, are very similar. Among the Mæcurú specimens are examples in which the dorsal valve is more convex than is usually the case with the Ereré forms, and the beak of the ventral valve is sometimes more elevated. The dental plates at times reach forward a short distance into the valve, and the cardinal process is generally

broader than in the Ereré forms; but there seem to be no other differences of importance.

This species is the most abundant one in the Devonian sandstone of Ereré. It is nearly equally common in the sandstone of the Rio Mæcurú, but only a few very small specimens were brought from the Curuá. (Morgan Exs., 1870 and '71; Geol. Comm., 1876.)

Strophodonta perplana Hall.

Strophomena perplana Conr., Jour. Acad. Nat. Sci., VIII, p. 257, 1842. *Strophomena pluristriata* Conr., idem., p. 259. *Strophomena delthyris* Conr., idem., p. 258. *Strophomena crenistria* Hall, Rept. Fourth Geol. Dist. N. Y., p. 171, 1843. *Strophomena* (*Strophodonta*) *fragilis* Hall, Tenth Rept. State Cab. N. Y., p. 143, 1857. *Strophodonta fragilis* Hall, Rept. Geol. Survey of Iowa, p. 496, 1858. *Strophodonta perplana* Hall, Palæont. New York, IV, pp. 92 and 98, 1868.

This common species of the Devonian of New York State, ranging there through the Upper Helderberg, Hamilton and Chemung groups, occurs very abundantly in the Devonian sandstones of the Rios Mæcurú and Curuá, and in these localities undergoes many of the variations peculiar to it in N. Y. It sometimes attains a very large size. (Geol. Comm., 1876.)

Spirifera duodenaria (?) Hall.

Delthyris duodenaria Hall, Geol. Rept. 4th Dist. N. Y., p. 171, 1843. *Spirifer duodenaria* Hall, Twelfth Rept. State Cab. N. Y., p. 88, 1859. *Spirifera duodenaria* Billings, Canadian Jour., p. 256, 1861; Geology of Canada, p. 372, 1863; Hall, Palæont. N. Y., IV, p. 189, 1868.

The commonest species of *Spirifera* at the Rio Mæcurú locality is one which belongs very near to *Spirifera duodenaria*, if it is not identical with it. The Brazilian variety is sometimes more transverse than *S. duodenaria*, of New York. The plications of the shell are generally of the same size, but are sometimes smaller. The ventral sinus is of more uniform size in the Brazilian, than in the American variety, and seldom becomes as broad at the front. The cardinal extremities are never much flattened in the dorsal valve, and never at all in the ventral, though this portion of the valve is almost always smooth. The depressions intervening between the plications are generally narrower than the plications themselves, and are regularly rounded. The hinge-area is narrow as in *S. duo-*

denaria, and in this character alone does it appear to differ from *S. speciosa* Schloth., of England and Germany. There exists in the collection of the Geological Commission a fragment of a ventral valve of very large size, five or six times that ordinarily attained by this species.

Very abundant in the Devonian sandstone of the Rio Mæcurú, but not found at either of the two other Devonian localities. (Geol. Comm., 1876.)

Spirifera Derbyii, sp. nov.

Shell of medium size, transverse; broadly semi-elliptical in outline; proportions of length to breadth about as 3 to 4; hinge line slightly shorter than the width of the shell; cardinal angles regularly rounded. The lateral margins, together with the anterior, form quite a regular, broad, semi-elliptical curve, slightly indented in front, where the fold and sinus reach the margin.

Dorsal valve moderately gibbous, and most elevated just posterior to the middle, towards which the surface arches up rapidly from the beak, but it curves down more gradually toward the front, the surface being slightly flattened on the fold, anterior to the middle. From the median fold the sides slope quite regularly to the lateral margins, and are nearly straight. Beak small and only slightly produced beyond the hinge line; median fold prominent, much elevated, and increasing quite rapidly in size toward the front. At the beak it is very fine, and rounded on top, but toward the front it becomes flattened. Throughout its entire length it is quite narrow above; its sides are broad and straight and slope abruptly downwards. Proportions of the width of the fold on top to its width below, at the front margin, about as 1 to 3. There are on each side of the fold five regularly rounded, simple plications, and generally a sixth indistinct one can be made out. These plications are very much smaller than the fold, and they are separated by rounded depressions of equal or slightly greater width. The first three plications on either side are well defined and begin quite close to the beak; the fourth, fifth and sixth are successively smaller and more flattened. The bases of the cruræ on each side of the beak are quite broad and heavy.

All the specimens definitely referable to this species are dorsal valves; there was found, however, a fragment of the ventral valve of a *Spirifera*, which may belong to this species. It has a moderately deep, rounded sinus, and six rounded plications on each side. The hinge area is of moderate width and curved; the beak, small

and neither much elevated nor strongly incurved. Size of the largest dorsal valve found; length 25 mm., breadth 33 mm.

There seems to be no species of *Spirifera* in the Devonian of N. America with which the form under discussion can be compared. It has the appearance of a much lengthened *S. duodenaria*. Only three specimens have been found, a dorsal and a ventral (?) valve, in the sandstone of the Rio Mæcurú, and a small dorsal one in the sandstone of the Rio Curuá. (Geol. Comm., 1876.)

***Spirifera Pedroana* Hartt, MS.**

Rathbun, Bull. Buff. Soc. Nat. Sci., i. no. 4, p. 237, pl. VIII, 1874.

Collections made since the original description of this species was published have furnished some new forms of *Spirifera*, very closely related to this species, if not identical with it. From the want of sufficient material to better characterize these varieties, I have placed them provisionally in the species *S. Pedroana*. We can separate the specimens into two general varieties, in the first of which the ventral valve has a rather broad hinge area, very slight curvature of the surface from the beak to the front margin, and also well developed, rather large and long, dental plates, which sometimes reach nearly to the front of the valve. In the character of the dental plates this variety approaches *S. Elizæ* Hartt, but it always has well marked plications, by which the two species can be readily distinguished. In the second variety, which is connected to the first by many intermediate forms, the ventral valve is much less convex, very slightly curved, with the margins very regularly curved, and the cardinal extremities rounded. On either side of the median sinus there are at times as many as twenty-four plications, and such examples often resemble the flattened forms of *S. medialis*, of the Hamilton group of New York. This extreme variety may eventually prove to be distinct from *S. Pedroana*.

The localities at which the different varieties of this species have been found are as follows: Devonian sandstone of Ereré, very abundant; Rios Mæcurú and Curuá very rare, especially the typical forms; but several odd varieties were obtained from these localities. In the collection from the Curuá there is a single large specimen, having a width of 70 mm. At the falls of Teupixima on the Rio Mæcurú, there is a fine-grained micaceous sandstone, containing *S. Pedroana* and *Rhynchonella dotis*. The former occurs of small size and is usually quite transverse, with a thin shell.

(Morgan Exs., 1870 and '71; Geol. Comm., 1876.)

Spirifera Elizæ Hartt, MS.

Rathbun, Bull. Buff. Soc. Nat. Sci., 1, no. 4, p. 239, plates VIII and IX, 1874.

Although this species resembles very much *S. Pedroana* in some of its varieties, intermediate forms to unite the two are wanting. This form is quite rare in the Devonian sandstone of Ereré, the only locality in which it has been found. (Morgan Exs., 1870 and '71; Geol. Comm., 1876.)

Spirifera Buarquiana, sp. nov.

Shell attaining a large size, gibbous, transverse, subelliptical in outline, and with the breadth nearly two and one-half times the length; hinge line much shorter than the width of the shell; surface plicate.

Dorsal valve most convex near the middle, the surface first rising abruptly upward along the fold from the beak, for a short distance, and then arching strongly and quite regularly to the front margin. From the median fold to the lateral margins, on either side, the surface slopes very regularly and is nearly straight. The entire posterior part of the valve on both sides of the median line is very much inflated, and the slopes from there toward the hinge line are very abrupt. Beak very small and scarcely elevated above the hinge. Fold of medium size and enlarging with moderate rapidity toward the front, flattened on top and with its sides straight and abrupt. Its width above equals about one-half its width at the base, and its height at the front equals about one-third its width at the same point. On each side of the median fold are eight prominent, regularly rounded, simple plications, separated by slightly narrower, rounded depressions. There exists toward the front a single, well defined line of growth. Length of valve about 25 mm. or slightly more, breadth about 64 mm.

The large dorsal valve, above described, has been taken as the type of the species. Not being perfect it was impossible to entirely complete the description of the shell. There are besides the specimen described five or six dorsal and ventral valves of smaller size, which, though they present in a general way the characters of this species, yet differ so much from it in some details, as to render their identification with it somewhat uncertain. These forms are all from the Devonian sandstone of the Rio Mæcurú. (Geol. Comm., 1876.)

I take pleasure in dedicating this species to Dr. Buarque de Macedo, chief of the department of Public Works of Brazil, to whom Sci-

ence is greatly indebted for his constant support of the best interests of the Geological Commission.

Spirifera, sp. indet.

There is a single large dorsal valve of a *Spirifera*, which bears some resemblance to those varieties of *S. granulifera* of the Hamilton group, having the cardinal extremities rounded. The surface arches strongly and regularly from side to side, and also strongly from the front margin to the beak, which latter is prominent and strongly incurved. There is no flattening at the cardinal extremities. Near the beak the fold is narrow, low, rounded, and marked with a slight longitudinal depression along the middle. The hinge line is slightly shorter than the width of the valve. There are, on each side of the fold, thirteen or fourteen very low, rounded, almost flattened plications, which are rather closely arranged, and the surface is also marked with several rather strong lines of growth. The width of this specimen is about 50 mm., length 38 mm.

Devonian sandstone, Eseré. (Geol. Comm., 1876.)

Spirifera Valenteana Hartt, MS.

Rathbun, Bull. Buff. Soc. Nat. Sci., 1, no. 4, p. 241, pl. VIII, 1874.

Of this species only one specimen has been found, the one from which the original description was made. Devonian sandstone, Eseré. (Morgan Ex., 1871.)

Spirifera Harttii, sp. nov.

Shell rather above the medium size, transverse, and with the proportions of length to breadth about as 7 to 11; in outline transversely subelliptical; hinge line slightly shorter than the width of the shell; cardinal extremities rounded, the greatest width of the shell being slightly anterior to the hinge line.

Dorsal valve moderately convex, the surface rising with gentle, regular curvature from the front margin to near the beak, toward which it bends abruptly downward, causing the beak to be somewhat flattened or apparently pressed down from behind. The valve is slightly flattened at the cardinal extremities and for some distance inward close to the hinge line, in front of which the umbonal region is strongly inflated over a great width. From side to side, across the middle, the curve of the surface is rather gentle and quite regular. The median fold is distinct quite to the beak, but on the posterior portion of the valve it is not much elevated above the general surface; it increases only gradually in height, but quite rapidly in width, its width at the front equalling about one-fourth that of the

valve. It is regularly rounded from side to side, but on the anterior half it is marked with two longitudinal, shallow and narrow, but defined depressions, giving it there a three-lobed character. In one specimen the central lobe is slightly broader than the laterals; in another the central lobe is the narrower. On each side of the fold are eight simple, rounded plications, separated by slightly narrower, rounded depressions, the plications growing successively smaller in size toward the sides, and the more lateral ones bending slightly outward as they extend from the hinge line toward the margin. The plications are not very distinctly marked on the posterior part of the valve. Only two dorsal valves of this species are known. The larger is imperfect, but the smaller has the following dimensions; length 21 mm., breadth 33 mm., depth of dorsal valve 5.5 mm. Ventral valve unknown.

This species of *Spirifera* is readily distinguished by the three-lobed character of the dorsal median fold. In all of the other Devonian species from Brazil, the median fold is simple.

Devonian sandstone, Rio Mæcurú. (Geol. Comm., 1876.)

***Spirifera mæcuruensis*, sp. nov.**

Shell minute, gibbous, with rounded cardinal extremities, and about four low, broad, rounded plications on the ventral valve.

Ventral valve very convex; length and breadth about equal; in outline forming obliquely a nearly square figure, but with the anterior margin of the shell slightly rounded. The surface arches strongly upward from the front, along the median line, to a point a short distance back of the middle of the valve, whence it curves slightly downward to the beak. Beak large and prominent, and much extended behind the hinge line, but only slightly incurved. Hinge area broad, triangular and very slightly concave; inclining strongly forward from the beak, so as to form an angle of about 110° to 120° with the plane of the shell margins. The distance from the hinge line to the beak is equal to nearly one-third the entire length of the valve, and in the triangular figure formed by the hinge area, the base, represented by the hinge line, is equal to about one and one-half times the length of each of the other two sides. Cardinal margins not sharply defined, the surface curving rapidly over from the hinge area into the general surface of the valve. Length of the hinge line equal to nearly two-thirds the width of the valve; cardinal extremities regularly rounded; fissure large, triangular, but widening only gradually from the beak toward the hinge line, where its width is

about one-fourth the length of the hinge. A shallow, rounded median depression extends from the beak to the front margin. It is bordered on each side by a rounded fold of about its own width, which, however, descends much more rapidly on the outer side than on the inner, to another much less defined depression, reaching quite to the cardinal margin. From these lateral depressions outward the valve is slightly convex, or forms a low, very broad fold which extends to, and includes, the cardinal extremities. The margins of the shell are made very sinuous by these foldings of the surface. Length and breadth of the ventral valve each about 5.5 mm. Dorsal valve unknown.

This very small species of Spirifera resembles much *S. disparilis* Hall, of the Corniferous limestone of New York. It is readily distinguished from the North American form, however, by its smaller size, greater proportionate length, flatter hinge-area and different character of plications, etc.

Only a few specimens were obtained; these were all found in the sandstone of the Rio Mæcurú. (Geol. Comm., 1876.)

Ambocœlia (?) sp. indet.

There were encountered in the fossiliferous sandstone beds of the Rio Curuá several very small spiriferoid shells, resembling much in shape *Ambocœlia umbonata* Hall, of the Hamilton Group of New York State. The specimens were all, however, in too imperfect condition to permit of proper identification.

Cyrtina (?) **Curupira** Rathbun.

Bull. Buff. Soc. Nat. Sci., 1, no. 4, p. 242, pl. x, 1874.

Quite rare in the sandstone at Eréré. (Morgan Exs., 1870 and '71.)

Retzia Jamesiana Hartt, MS.

Rathbun, Bull. Buff. Soc. Nat. Sci., 1, no. 4, p. 243, pl. x, 1874.

A number of specimens of *Retzia*, identical with the *R. Jamesiana* of Eréré, were obtained from the Devonian sandstone of the Rio Mæcurú. From the same locality there are also other specimens, differing from the above in having more prominent and subangular plications, and a second variety has a much broader shell. It is doubtful whether these two latter forms should be included in *R. Jamesiana* or be separated from that species.

Devonian sandstone, Eréré. (Morgan Exs., 1870 and '71; Geol. Comm., 1876.) Rio Mæcurú. (Geol. Comm., 1876.)

Retzia Wardiana Hartt, MS.

Rathbun, Bull. Buff. Soc. Nat. Sci., 1, no. 4, p. 245, pl. x, 1874.

A few specimens of *Retzia*, which probably represent only a variety of *R. Wardiana*, are contained in the collections made on the Rios Mæcurú and Curuá. They agree in form with the *Ereré* specimens, but the plications on the shells from the two former localities are slightly larger, and fewer in number, there being about twelve on each valve.

Devonian sandstone, *Ereré*. (Morgan Exs., 1870 and '71; Geol. Comm., '76.) Rios Mæcurú and Curuá. (Geol. Comm., 1876.)

***Rhynchonella ererensis*, sp. nov.**

Shell of large size, suborbicular in shape and marked with prominent, separated plications; length only very slightly greater than the width; thickness through the two valves apparently nearly equal to the width.

Dorsal valve subcircular in outline with a slightly projecting, sharply pointed beak; cardinal margins moderately concave and extending far forward. Viewed from the side, the surface rises rapidly upward from the beak, along the median line, in quite a regular curve for about one-half the length, whence to near the front the surface is quite straight, but slightly rising. It curves abruptly downwards toward the ventral valve, and is much flattened on each side of the front margins of both valves. From side to side the curvature of the dorsal valve is very strong, but not regular, the valve being somewhat flattened along the median line, especially toward the umbone.

The median fold begins near the centre of the valve, and increases only slightly in prominence towards the front. Its width is about two-fifths that of the valve, and it is marked with four prominent rounded or sub-angular plications, which are separated by similar depressions. On each side of the fold there are six well defined plications, and besides these exist one or two very indistinct ones near the hinge. The plications nearest the fold are the most prominent, being slightly smaller than those of the fold; they are rounded on top or slightly angular, and each slopes down more gradually on its outer than on its inner side. The depressions separating the plications are from two to three times the width of the latter. The plications are only faintly indicated on the umbonal region; they cause the anterior margins of both valves to be strongly digitate. The median septum of the ventral valve reaches about half way to the front; it is prominent and heavy near the beak, but grows gradually more slender forward, being reduced to a mere line near the centre of the valve.

The entire length of the shell is 28 mm., width 26 mm., depth of the dorsal valve 15 mm., width of fold at the front about 11 mm.

Only a single specimen of this large species of *Rhynchonella* was obtained; this is the cast of a dorsal valve, with a portion of the ventral valve attached. It is readily distinguished from the other species recorded in this paper, by its larger size, greater proportionate length, and the more extended, pointed beak of the dorsal valve.

From the Devonian sandstone of Eréré. (Geol. Comm., 1876.)

***Rhynchonella* (*Stenocisma*) *dotis* (?) Hall.**

Rhynchonella (*Stenocisma*) *dotis* Hall, Palæont. of New York, IV, p. 344, pl. LIV, 1867; Rathbun, Bull. Buff. Soc. Nat. Sci., I, no. 4, p. 246, pl. VIII, 1874.

This species was first recorded from Brazil in the report of the Morgan Expeditions referred to above. At that time only two specimens were known from the Devonian sandstone of Eréré. These were both dorsal valves, which agreed quite closely in their characters with *Rhynchonella dotis* of the Hamilton group of New York. The Geological Commission discovered no more specimens of this species at Eréré; but in the sandstone beds of the Rios Mæcurú and Curuá were found many specimens of *Rhynchonella*, representing several varieties, of which the most are closely connected together and to the Eréré variety, by intermediate forms. Some of the varieties, however, present differences which may necessitate their being separated eventually from the commoner form. The result of the studies made on these varieties of *Rhynchonella* indicate that this species from Brazil may prove to be as closely related to some other of the N. American species as to *R. dotis*; but I was unable to make comparisons with a sufficiently large collection, and thus it has seemed best to retain the species as it is for the present.

As a rule, the shell of the Brazilian form is more or less transverse, or has the length and breadth nearly equal. Ventral valve short-ovate in outline; dorsal valve very short-ovate or transversely subelliptical. Of the ventral valve the beak is small, quite sharply pointed, and strongly incurved. The posterior margins diverge at an angle of about 105° to 115° , and are nearly straight. Anterior margin broadly, but not deeply, indented by the sinus. The surface of the valve is generally much flattened toward the front, and curves rapidly downward toward the front and lateral margins.

Dorsal valve very convex, the surface rising regularly and rapidly from the beak to near the anterior margin, toward which it curves

down abruptly. The fold begins a little posterior to the middle and increases gradually in size forward, its width at the front equalling two-fifths to one-half the width of the valve.

There are from fourteen to eighteen plications on each valve, of which from three to four occupy the fold and two to three the sinus. Size of a large specimen; length 18 mm., breadth 23 mm.; but this is above the average. Although the sinus and fold are both generally well defined at the sides, yet on many of the smaller specimens they are only slightly marked, and in a few examples there are either two or five plications on the fold, and two or four in the sinus. These are rounded or subangular on top, and the depressions separating them are subequal in size, or slightly narrower or broader.

From the Rio Mæcurú there is a variety resembling much in appearance *R. Horsfordi* Hall. It has finer plications and a greater proportionate breadth than the common Brazilian form, and the fold bears five plications. In a fine micaceous sandstone at the falls of Teuapixima, on the Rio Mæcurú, were found small specimens of this species, resembling more the *Ereré* than the Mæcurú variety. The shell of this form is very thin and delicate. At the same locality were encountered *Spirifera Pedroana* and *Tentaculites Eldregianus*, but no other fossils.

Ereré. (Morgan Ex., 1871.) Rios Mæcurú and Curuá. (Geol. Comm., 1876.)

Amphigenia elongata Hall.

Pentamerus elongatus Vanuxem and Hall, Reports Third and Fourth Geol. Dists. N.Y., pp. 132 and 34, 1842 and '43. *Meganteris elongatus* Hall, Tenth Report on the State Cabinet, N. Y., p. 123, 1857. *Rensselæria elongata* Hall, Palæont. of N. Y., III, p. 453; Twelfth Report on the State Cabinet, N. Y., p. 37, 1859. *Stricklandia elongata* Billings, Canadian Jour. no. XXXIII, p. 268, 1861; Geology of Canada, p. 371, 1863. *Amphigenia elongata* Hall, Palæont. of N. Y., IV, p. 383, pl. LIX, 1867.

This large species of Brachiopod is very abundant in the sandstone beds of the Rios Mæcurú and Curuá. The moulds of the shells are generally found in a perfect state of preservation, often finely representing the internal characters. In its younger stages of growth the shell is usually short-ovate in outline, afterwards becoming elongate-oval and often subcylindrical in general shape. A large specimen has a length of 100 mm., and a breadth of 45 mm. The only marked difference noted between the Brazilian form and

the North American, is the absence of radiating raised lines on the former; but this is probably due to the coarse character of the rock in which the specimens were found.

Rios Mæcurí and Curuá. (Geol. Comm., 1876.)

Terebratula Derbyana Hartt, MS.

Rathbun, Bull. Buff. Soc. Nat. Sci., 1, no. 4, p. 236, pl. x, 1874.

This species was obtained at Ereré in great abundance in 1876 by the Geological Commission. Specimens of larger size than before known were collected by them, but none giving a clearer idea of the true relations of the species. The largest specimen found measures in length 14 mm., in breadth 10 mm. From the Rio Curuá was procured a ventral valve of a small specimen of *Terebratula*, probably belonging to this same species.

Ereré. (Morgan Exs., 1870 and '71; Geol. Comm., 1876.) Rio Curuá. (Geol. Comm., 1876.)

Tropidoleptus carinatus Hall.

Strophomena carinata Conr., Ann. Geol. Rept. of N. Y., p. 64, 1839.

Leptæna laticosta Hall, Owen and others. *Tropidoleptus carinatus* Hall, 10th Rep. St. Cab. N. Y., p. 151, 1857; Palæont. N. Y., iv, p. 407, pl. LXII, 1867; Rathbun, Bull. Buff. Soc. Nat. Sci., 1, no. 4, p. 254, pls. ix and x, 1874.

The description of the Brazilian form, in the Bulletin of the Buffalo Society of Natural Science, referred to above, was made from a few specimens collected at Ereré in 1871. The collection made by the Geological Commission in 1876, however, contains many varieties resembling more closely the species as it is known in N. America. This last collection has also many very large specimens.

The length and breadth of the younger shells are sometimes nearly equal, and the cardinal extremities are rounded or acutely angular. In the older forms the shell is frequently transversely subelliptical. The ventral valve is often subcarinate along the middle, the carina including from one to three plications, and the central plication of this valve is always the larger, whether the carina exists or not. The younger shells are not carinate. A depression, corresponding to the carina of the ventral valve, usually exists in the dorsal valve. The largest specimen examined has a length of 31 mm., and a breadth of 42 mm.; there are also many other specimens in the collection nearly equalling this one in size.

Rare at the Ereré locality. (Morgan Ex., 1871; Geol. Comm., 1876.) Very abundant on the Rios Mæcurí and Curuá. (Geol.

Comm., 1876.) This species was also found by Mr. A. Agassiz, associated with *Vitulina pustulosa*, in Devonian deposits on the island of Coati, Lake Titicaca, Bolivia.

***Vitulina pustulosa* Hall.**

Vitulina pustulosa Hall, 13th Rep. St. Cab. N. Y., p. 82, 1860; Palæont. of N. Y., IV, p. 410, 1867; Rathbun, Bull. Buff. Soc. Nat. Sci., I, no. 4, p. 255, pl. IX, 1874.

This species is very abundant in the sandstone beds of Ereré and the Río Mæcurú, and the specimens from these two localities agree quite closely with one another in all their variations. A slender septum is often preserved in the ventral valves from the Mæcurú, and specimens from this locality often have more prominent plications than those from Ereré. Only a few very small specimens were found on the Río Curuá.

Ereré. (Morgan Exs., 1870 and '71; Geol. Comm., 1876.) Ríos Mæcurú and Curuá. (Geol. Comm., 1876.)

CONCLUSIONS.

To aid in comparing the faunæ of the three Amazonian Devonian localities, there is given in the following table a list of the species described in the preceding pages, with the locality or localities at which each was found.

By reference to this list it will be seen, that of the twenty-one species recorded from the Mæcurú, thirteen were also found on the Curuá, all the commoner species of the former locality, excepting *Spirifera duodenaria* (?), being represented at the latter place. The relationship existing between the Ereré fauna and the Mæcurú is not so close. No *Lingulæ* were obtained on the Mæcurú, though two species were found in the Ereré sandstone. *Chonetes Comstockii*, so abundant, and often of large size, at Ereré, is rare on the Mæcurú, and *C. Herbert-Smithii* is not found there at all. *Spirifera Pedroana*, *Retzia Jamesiana* and *R. Wardiana*, all abundant at Ereré, are very sparingly represented on the Mæcurú.

On the other hand the common Mæcurú species, *Orthis Harttii*, *Strophodonta perplana*, *Spirifera duodenaria* (?) and *Amphigenia elongata* do not occur at Ereré; and there are several types of *Spirifera* and a *Productella* confined to the Mæcurú beds. *Chonetes Freitasii*, *Orthis Nettoana*, *Rhynchonella dotis* and *Tropidoleptus carinatus* are very abundant in the Mæcurú beds, but in the collection from Ereré they are represented by only a few specimens each. *Streptorhynchus*

Agassizii and *Vitulina pustulosa* are about equally abundant at the two localities.

LIST OF PARÁ DEVONIAN BRACHIOPODS.		Eréré.	Mæcurú.	Curuá.
1.	<i>Lingula spatulata</i> (?) Hall	*		
2.	<i>Lingula ererensis</i> Rathbun	*		
3.	<i>Lingula Rodriguezii</i> Rathbun	*		
4.	<i>Lingula Stauntoniana</i> Rathbun	*		
5.	<i>Lingula Graçana</i> Rathbun	*		
6.	<i>Discina lodensis</i> Hall	*		
7.	<i>Productella mæcuruensis</i> Rathbun		*	
8.	<i>Chonetes Comstockii</i> Hartt	*	*	
9.	<i>Chonetes Freitasii</i> Rathbun	*(?)	*	*
10.	<i>Chonetes Onettiana</i> Rathbun	*		
11.	<i>Chonetes Herbert-Smithii</i> Hartt	*		
12.	<i>Chonetes curuaensis</i> Rathbun		*	*
13.	<i>Chonetes</i> (sp. indet.)		*	
14.	<i>Orthis Nettoana</i> Rathbun	*	*	*
15.	<i>Orthis Harttii</i> Rathbun		*	*
16.	<i>Streptorhynchus Agassizii</i> Hartt.	*	*	*
17.	<i>Strophodonta perplana</i> Hall		*	*
18.	<i>Spirifera duodenaria</i> (?) Hall		*	
19.	<i>Spirifera Derbyi</i> Rathbun		*	*
20.	<i>Spirifera Pedroana</i> Hartt	*	*	*
21.	<i>Spirifera Elizæ</i> Hartt	*		
22.	<i>Spirifera Buarquiana</i> Rathbun		*	
23.	<i>Spirifera (granulifera</i> (?))	*		
24.	<i>Spirifera Valenteana</i> Hartt	*		
25.	<i>Spirifera Harttii</i> Rathbun		*	
26.	<i>Spirifera mæcuruensis</i> Rathbun.		*	
27.	<i>Cyrtina</i> (?) <i>Curupira</i> Rathbun	*		
28.	<i>Retzia Jamesiana</i> Hartt	*	*	
29.	<i>Retzia Wardiana</i> Hartt	*	*	*
30.	<i>Rhynchonella ererensis</i> Rathbun	*		
31.	<i>Rhynchonella dotis</i> Hall	*	*	*
32.	<i>Amphigenia elongata</i> Hall		*	*
33.	<i>Terebratula Derbyana</i> Hartt	*		*(?)
34.	<i>Tropidoleptus carinatus</i> Hall	*	*	*
35.	<i>Vitulina pustulosa</i> Hall	*	*	*

Thus, as a rule, the commoner Mæcurú species are not found at Eréré, or are poorly represented there; and the same is true of the commoner Eréré forms on the Mæcurú. The genus *Cyrtina* (?) is peculiar to Eréré, and four genera, *Productella*, *Strophodonta*, *Amboœlia* (?) and *Amphigenia* are only found on the Mæcurú.

As indicated in the foregoing pages, several of the Amazonian Devonian species are identical with North American Devonian. Beginning with the lowest Pará beds, those of the Mæcurú and Curuá, we find three species not occurring at Eréré, which are the same as North American species; they are *Spirifera duodenaria* (?), *Amphigenia elongata* and *Strophodonta perplana*. Of these species two are known

only from the Corniferous limestone and Schoharie grit of North America, and *Strophodonta perplana* is found in the same formations and also in the Hamilton and Chemung groups. Of species much more abundant in the Mæcurú than the Eréré beds; *Tropidoleptus carinatus* is essentially a Hamilton group form; *Chonetes Freitasii* in its younger stages resembles *C. deflecta* of the Hamilton, but the larger, more abundant forms are represented in New York State by the larger type of *Chonetes* of the Corniferous limestone. *Rhynchonella lotis* of the Mæcurú is probably as closely related to some of the Corniferous *Rhynchonellæ* as to any of the Hamilton. I have been unable to make satisfactory comparisons of the *Orthes*, but they are of North American Devonian types.

Of the new species of Mæcurú *Spiriferæ*; *Spirifera mæcuruensis* is closely allied to *S. disparilis* of the Corniferous, and *S. Derbyi* resembles *S. varicosta* of the same formation.

Of the species peculiar to the Eréré beds, or most abundant there; *Spirifera Pedroana* appears to have related species in both the Corniferous and Hamilton groups of N. America; *Chonetes Comstockii* represents *C. coronata* of the Hamilton group; and *Retzia Jamesiana* is most like *R. lepida* of the same formation. *Spirifera granulifera* of the Hamilton group of N. America is represented at Eréré by a similar species, and *Lingula spatulata* is a Hamilton group species. As might be expected, *Streptorhynchus Agassizii* is as common to both the Mæcurú and Eréré beds as the North American species, which it represents, is common to the Corniferous, Hamilton and Chemung groups of New York State, etc.

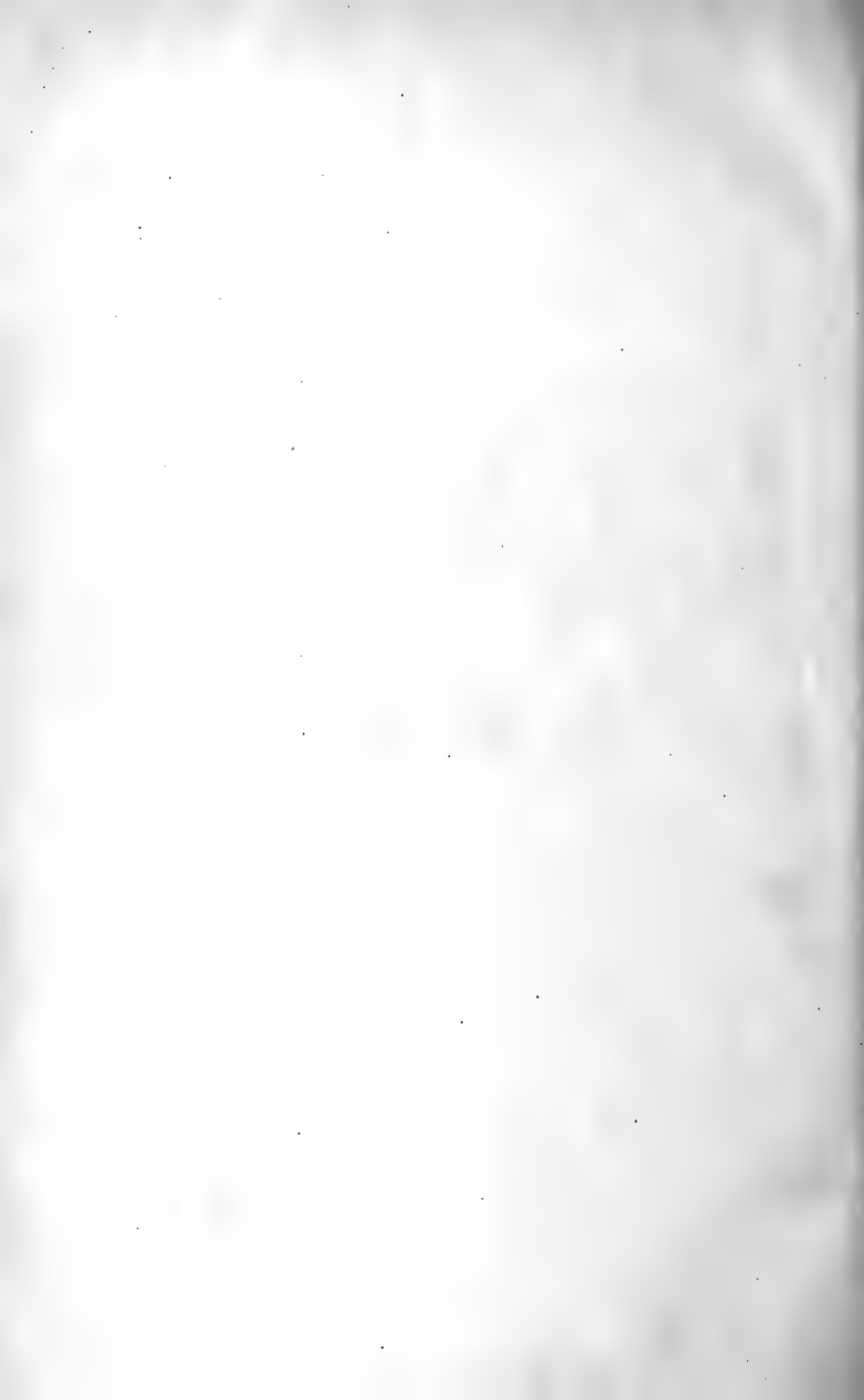
It would appear from the preceding comparisons that the Eréré beds, as determined by their fossils, and as before indicated in my previous paper on the Eréré Brachiopods, are more closely related to the Hamilton group than to any other North American formation; but the Mæcurú and Curuá fossiliferous beds, although they contain a sufficient number of Eréré species to prove their close connection with the deposits at the latter place, yet they also bear a nearer relationship to the Corniferous group of New York State, than do the Eréré beds. In Pará we have the same general order of succession of species as in the Corniferous and Hamilton groups of N. America, and a similar intermingling of forms. The number of species of Brachiopods recorded from the Brazilian Devonian is so much smaller than that known from N. America, and the fossiliferous localities visited are so few, that we must expect further explorations to more

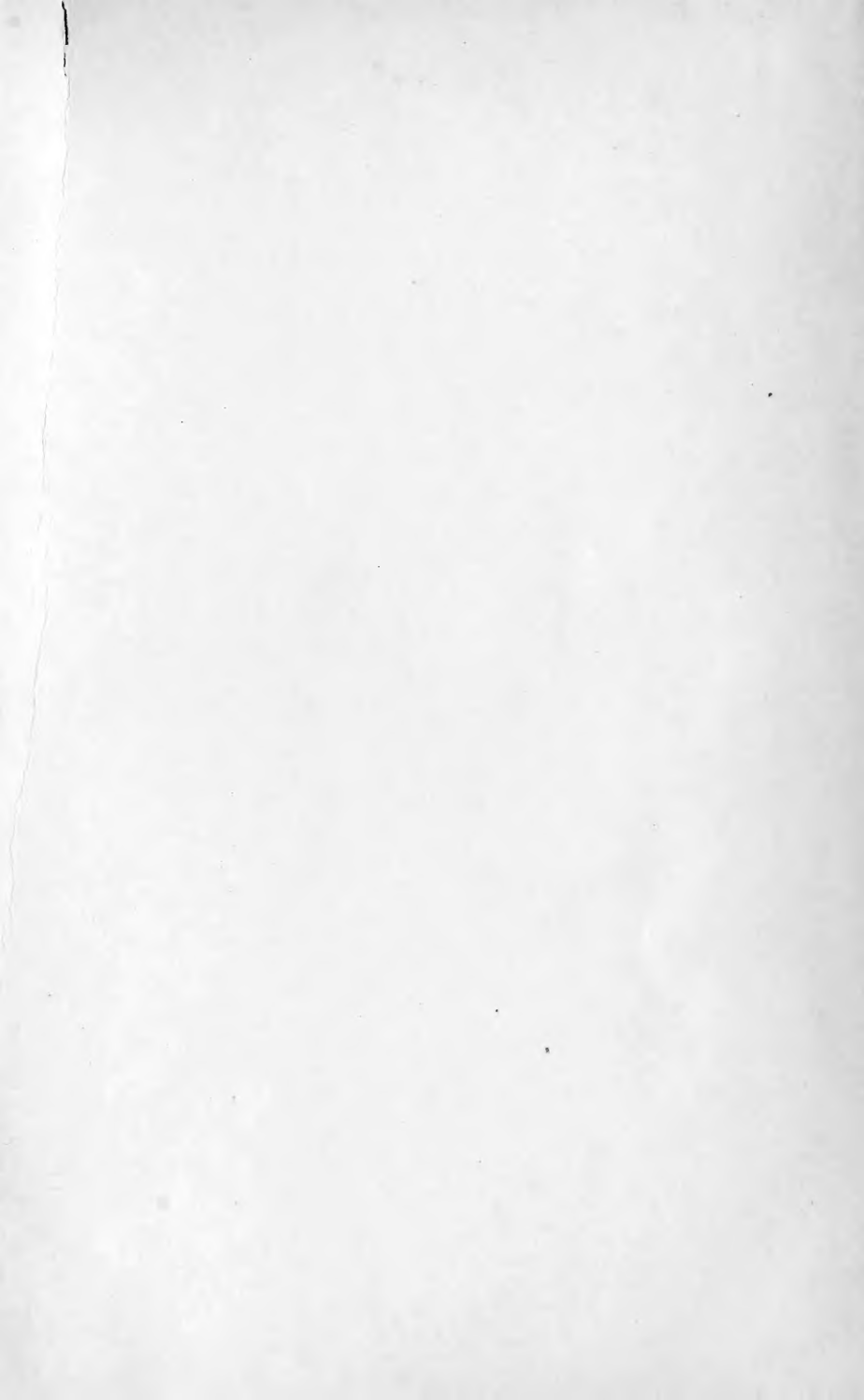
or less alter the above conclusions. The difference in the character of the materials of the Mæcurú fossiliferous beds and the Corniferous is very marked. The former is composed mostly of rather coarse sandstones, the latter of limestones.

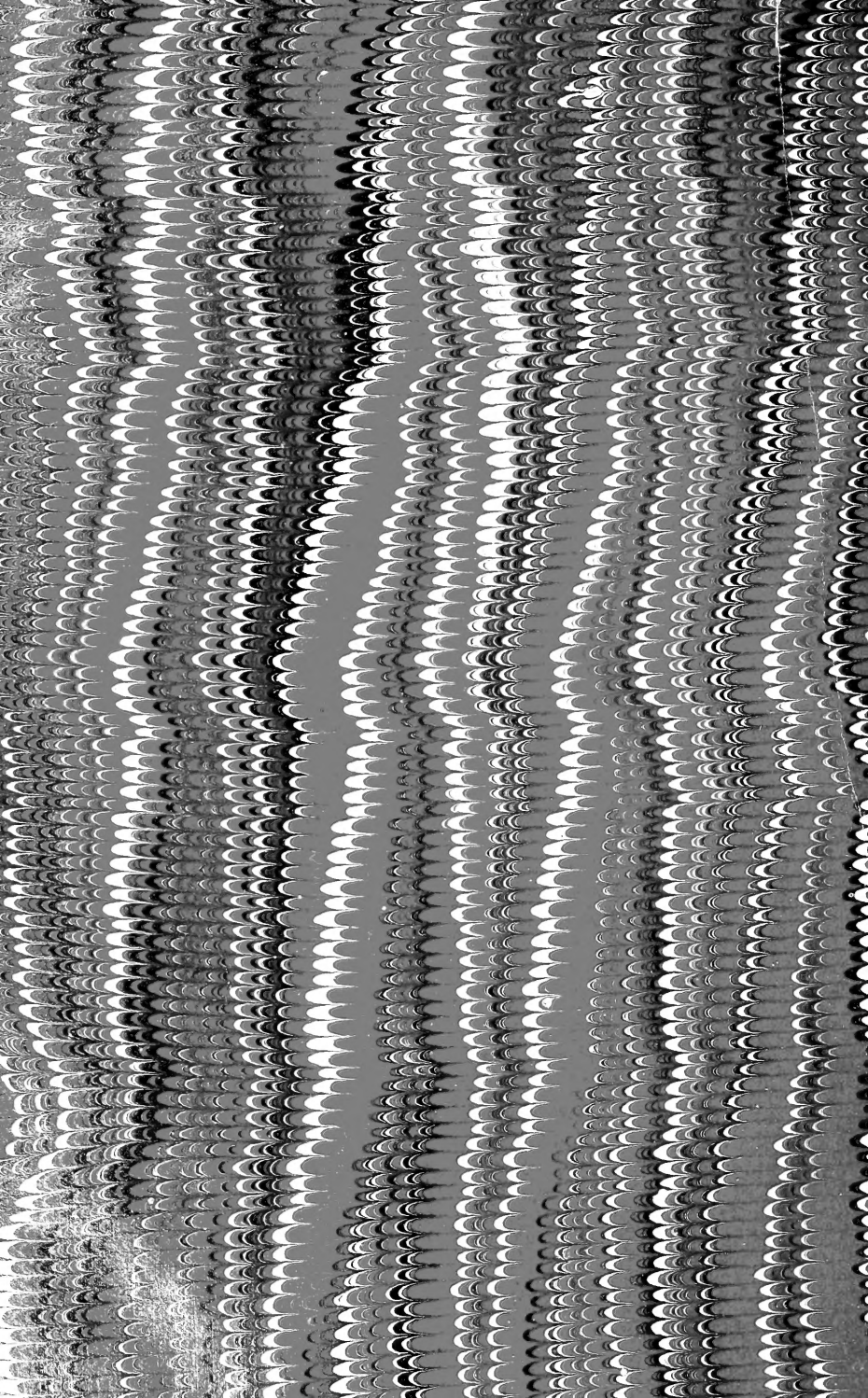
To complete the fauna of the Devonian of Pará there remains the large collection of Lamellibranchs and Trilobites from the Rios Mæcurú and Curuá, made by the Geological Commission in 1876. This collection is very extensive and represents a large number of species, which are mostly of North American Devonian types. From a hasty examination of the Lamellibranchs it seems probable that many of the species are identical with New York State forms. Several of the species are of large size, but I am unable to give here the names of the genera represented. Among the Trilobites are species of Homalonus, Phacops and other genera. It is likely that the study of the Trilobites and Lamellibranchs would help to establish more clearly the relations of the Pará Devonian to that of N. America. At Eréré there were discovered, besides the new Brachiopods, two new species of Lamellibranchs, in addition to those previously described (Annals of the Lyceum of Natural History of New York, vol. XI, pp. 110 to 127, 1875.) They are of very small size and belong to the genera Nucula and Leda.

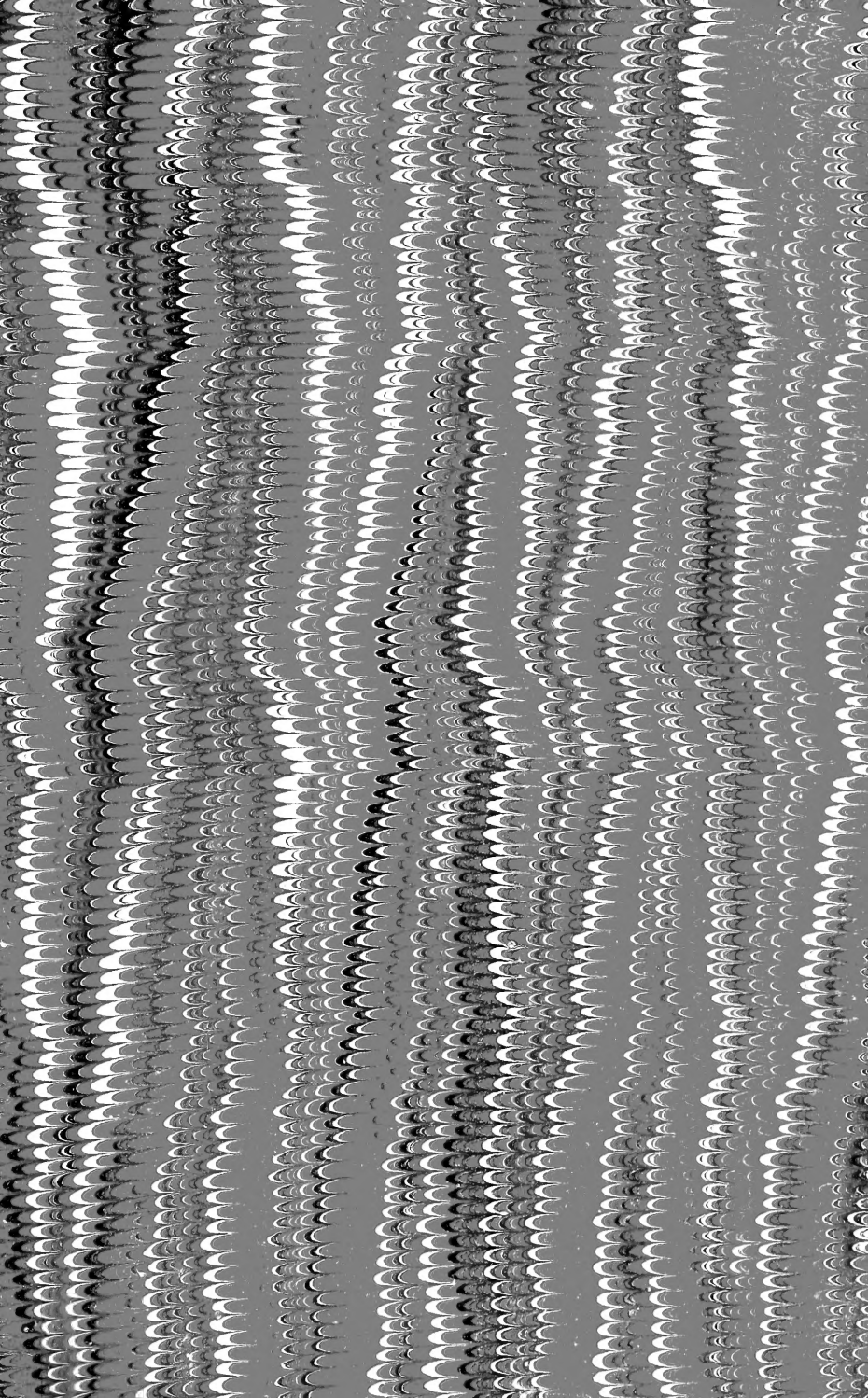
Tropidoleptus carinatus and *Vitulina pustulosa* were discovered by Mr. A. Agassiz in 1875 on the island of Coati, lake Titicaca, Bolivia, demonstrating the probable existence high up in the Andes of about the same Devonian horizon as occurs in Pará.











SMITHSONIAN INSTITUTION LIBRARIES



3 9088 01348 4373